

1.1 Water Quality Standards and TMDL Target Values

Under the Clean Water Act, every state must adopt water quality standards to protect, maintain, and improve the quality of the nation's surface waters. These standards represent a level of water quality that will support the Clean Water Act's goal of "swimmable/fishable" waters. Water quality standards consist of several different components:

- **Designated uses** reflect how the water can potentially be used by humans and how well it supports a biological community. Examples of designated uses include aquatic life support, drinking water supply, and full body contact recreation. Every waterbody in Indiana has a designated use or uses; however, not all uses apply to all waters. All surface waters in the Busseron Creek watershed have been designated to support a well-balanced, warm water aquatic community [327 IAC 2-1-3. Sec. 3. (a) (2)(A)], which is the designated use relevant to the TMDLs presented in this report.
- Criteria express the condition of the water that is necessary to support the designated uses. **Numeric criteria** represent the concentration of a pollutant that can be in the water and still protect the designated use of the waterbody. **Narrative criteria** are the general water quality criteria that apply to all surface waters. The relevant narrative criteria that apply to the TMDLs presented in this report state the following:

"All surface waters at all times and at all places, including waters within the mixing zone, shall meet the minimum conditions of being free from substances, materials, floating debris, oil, or scum attributable to municipal, industrial, agricultural, and other land use practices, or other discharges that do any of the following:...

(a)re in concentrations or combinations that will cause or contribute to the growth of aquatic plants or algae to such degree as to create a nuisance, be unsightly, or otherwise impair the designated uses." [327 IAC 2-1-6. Sec. 6. (a) (1)(D)]

(a)re in amounts sufficient to be acutely toxic to, or to otherwise severely injure or kill, aquatic life, other animals, plants, or humans." [327 IAC 2-1-6. Sec. 6. (a) (1)(E)]

1.2 Target Values

Target values are needed for the development of TMDLs because of the need to calculate allowable daily loads. For parameters that have numeric criteria, the numeric criteria are used as the TMDL target value. For example, numeric criteria (that vary by hardness) exist for copper and zinc and equations that specify the criteria can be found in the Indiana Administrative Code at 2-1-6 Table 6-2.

For parameters covered only by narrative criteria, target values must be identified from some other source. For example, Indiana has adopted benchmarks for total phosphorus to quantify the narrative criteria that state that waters shall be free from substances that contribute to the growth of nuisance aquatic plants or algae. Additional information on the total phosphorus benchmark is presented in Appendix H.

Indiana's process for quantifying target values for toxics that do not have numeric criteria listed in the Indiana Administrative Code is explained at 327 IAC 2-1-8 in sections 8.2 through 8.9. This process was used to identify the target values for the aluminum, iron, and manganese TMDLs presented in this report.

because the actual criteria are not presented in Table 6-2 of the Indiana Administrative Code. Additional information on the aluminum, iron, and manganese criteria is presented in Appendix H.

Indiana has adopted both dissolved and total recoverable criteria for copper and zinc and both sets of criteria were used to evaluate impairment conditions within the watershed. However, loading capacities were based upon the total recoverable criteria because significantly more total recoverable data were available with which to assess current loads (and thus necessary reductions).

Indiana has also adopted both Acute Aquatic Criteria (AAC) and Chronic Aquatic Criteria (CAC) for copper, manganese, and zinc. Acute toxicity means a substance has been introduced that is severe enough to rapidly induce a response (e.g., within 96 hours or less). CAC represent the highest water concentration of a toxicant to which organisms can be exposed indefinitely without causing chronic toxicity. The copper, manganese, and zinc loading capacities in the Busseron Creek watershed were calculated using the chronic criteria because they were more restrictive and ensure that both standards will be met.

Table 1 summarizes the target values used for the Busseron Creek watershed TMDLs along with an explanation of how they were derived.

Table 1. Target values used for development of the Busseron Creek watershed TMDLs.

Parameter	Target Value	Source
Total phosphorus	No value should exceed 0.30 mg/L	This is a benchmark used by IDEM to interpret the narrative nutrient criteria (327 IAC 2-1-6).
pH	No pH values should be below six (6.0) or above nine (9.0), except daily fluctuations that exceed pH nine (9.0) and are correlated with photosynthetic activity, shall be permitted.	Numeric Criteria (327 IAC 2-1-6)
Dissolved Oxygen	Concentrations of dissolved oxygen shall average at least five (5.0) milligrams per liter per calendar day and shall not be less than four (4.0) milligrams per liter at any time.	Numeric Criteria (327 IAC 2-1-6)
Iron	No value should exceed 2.5 mg/L	This value was developed by IDEM following the process explained in 327 IAC 2-1-8; see Appendix H for details
Aluminum	No value should exceed 174 µg/L	This value was developed by IDEM following the process explained in 327 IAC 2-1-8; see Appendix H for details
Total Suspended Solids	No value should exceed 30 mg/L	This is a benchmark used by IDEM to interpret the narrative sediment criteria (327 IAC 2-1-6).
Copper	AAC (µg/L) = $WER (e^{(0.9422[\ln(\text{hardness})]-1.464)})$ Conversion factor = 0.96 ^a CAC (µg/L) = $WER (e^{(0.8545[\ln(\text{hardness})]-1.465)})$ Conversion factor = 0.96 ^a	Numeric Criteria (327 IAC 2-1-6). Table 6-2.
Zinc	AAC (µg/L) = $WER (e^{(0.8473[\ln(\text{hardness})]+0.8604)})$ Conversion factor = 0.978 ^a CAC (µg/L) = $WER (e^{(0.8473[\ln(\text{hardness})]+0.7614)})$ Conversion factor = 0.986 ^a	Numeric Criteria (327 IAC 2-1-6). Table 6-2.
Manganese	AAC (µg/L) = $(e^{(0.8784[\ln(\text{hardness})]+2.992)})$ CAC (µg/L) = $(e^{(0.8784[\ln(\text{hardness})]+2.226)})$	These equations were developed by IDEM following the process explained in 327 IAC 2-1-8; see Appendix H for details.

Notes: AAC = Acute Aquatic Criterion; CAC = Chronic Aquatic Criterion.

^a Dissolved criteria for each of these parameters are computed by multiplying the AAC and CAC by the corresponding conversion factor.